UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,568	03/29/2004	Rick Mountjoy	MR03-0001	1391

45467 7590 02/09/2007

GARY F. WITTING
5834 EAST OAK STREET
SCOTTSDALE, AZ 85257

EXAMINER	
CAJILIG, CHRISTINE T	
ART UNIT	**PAPER NUMBER**
3637	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/09/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.	Applicant(s)	
10/811,568	MOUNTJOY, RICK	
Examiner	**Art Unit**	
Christine T. Cajilig	3637	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 March 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/29/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☒ Other: *Foreign References*.

IDS - 03/29/2004

PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Rick Mountjoy
Art Unit	
Examiner Name	
Attorney Docket Number	MR03-0001

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
CTC		US- 5,444,948	08/29/1995	Trapp	
CTC		US- 4,704,754	11/10/1987	Bonasso	
CTC		US- 5,060,426	10/29/1991	Jantzen	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	/Christine T. Cajilig/	Date Considered	12/28/2006

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

DETAILED ACTION

Election/Restrictions

Applicant's election of Group I drawn to a construction element and the method of making a construction element in the reply filed on 12/20/06 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 26-28 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Group II, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 12/20/06.

Applicant's further election of the species requirement in the reply filed on 12/20/06 is acknowledged. Applicant elects with traverse for Species 1 of Group 1. It appears that Applicant intends that the traversal is on the ground(s) that Species 1 and Species 2 are not separate species. This is not found persuasive because Figure 1 shows a double layer beam with a flexible element having a course of blocks mounted on both the top and bottom surfaces of the flexible element which sandwiches the flexible element, while Figure 2, above arrows 112 shows a single layer beam with a flexible element having a single course of blocks mounted on the top surface of the flexible element. Furthermore, Figure 3 shows a single layer beam, such as the single layer beam in Figure 2 in use above a curved form element 310. Thus, Species 1 and 2 are patentably distinct species.

Upon further review of the claims, claims 22 – 25 also read on the elected Species 1, and thus, claims 1-25 and 29-31 will be examined on the merits. As Applicant has elected Group I, Species 1, Applicant's argument of the Species in Group 2 is moot at this time.

The requirement is still deemed proper and is therefore made FINAL.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: "438" in line 3 of page 11 and "708" in line 24 of page 14. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: "106" in Figure 2, "300" in Figure 3, and "440" in Figure 4. Corrected

drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The abstract of the disclosure is objected to because "flexible beam (74)" in line 9 of the abstract should read as "—flexible beam (10)—". Correction is required. See MPEP § 608.01(b).

The disclosure is objected to because of the following informalities: "then" in line 15 of page 5 and line 32 of page 12 should read as "—than—. " Reference number "20" in line 30 of page 9 is used to designate the adhesive; however, "20" has already been used to designate the surface of "16" as noted in line 19 of page 8. The recurring designation of "406-414," 420-426," 450-458," is misleading because reference numbers 407, 409, (odd numbers) etc. are not used in the drawings. Reference number

"406" in line 5 of page 11 should read as "—404—," because "404" was used to designate the beam as noted in line 27 of page 10.

Appropriate correction is required.

Claim Objections

Claims 2-5, 7, 9-14, 16-20, and 25 are objected to because of the following informalities: "A" should read as "—The—" in the first line of the dependent claims. Appropriate correction is required.

Claims 12 and 24 are objected to because of the following informalities: "element" should read as "—elements—" in the last line of the claims. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 5, 17, 22 and claims dependent therefrom, 23, and 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 5 recites the limitation "the second surface" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim 17 recites the limitation "the organic material" in lines 1-2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim 17 is further indefinite because of the use the word "organic" to describe a plastic material. The term "organic" is well known to mean as something that is derived from living organisms; thus, the use of the term "organic" to describe plastic is misleading and improper.

Claim 22 recites the limitation "the...second block" in line 4 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim 23 is indefinite because it is a method claim that depends from article claim 21. For purposes of examination, claim 23 is interpreted as being dependent from method claim 22.

Claim 25 recites the limitation "the second surface" in line 4 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3-8, 13, 15, 19-25, and 29-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Killen (U.S. Publication No. 2004/0128948).

Regarding claim 1, Killen in Figure 2 discloses a construction element comprising a flexible element (52) having a first surface (upper surface of 52 in contact with block

30); and a first block element (30) having a portion (surface of 30 in contact with 52) of the first block attached to the first surface of the flexible block element.

Regarding claim 3, Killen discloses a construction element as discussed above and further discloses that the flexible element is made of a web material (Pg 4, Par 92).

Regarding claim 4, Killen discloses a construction element as discussed above and further discloses an adhesive means (Pg 4, Par 91) for attaching the first block element to the first surface of the flexible element.

Regarding claim 5, Killen discloses a construction element as discussed above and further discloses a second block element (40) attached to a second surface (lower surface of 52 adjacent to 40) of the flexible element.

Regarding claim 6, Killen in Figure 2 discloses a construction element comprising a flexible element (52) having a first surface (upper surface of 52 in contact with block 30) and a second surface (lower surface of 52 in contact with block 40); a first block element (30); and an adhesive layer (Pg 4, Par 91) substantially adhering the first block element to the first surface of the flexible element.

Regarding claim 7, Killen discloses a construction element as discussed above and further discloses a second block element (40); a second adhesive layer (Pg 4, Par 91), the second adhesive layer substantially bonding the second block element to the second surface of the flexible element (Pg 4, Par 91).

Regarding claim 8, Killen in Figure 4 discloses a construction element comprising a flexible element (50) having a first surface (surface of 50 adjacent to "a" and 20); and a first block element (a) and a second block element (20), the first and second block

elements attached to the first surface of the flexible element with a space (14) between the first and second block elements.

Regarding claim 13, Killen discloses a construction element as discussed above and further discloses a filling material (grouting material, see Pg 4, Par 94) at least partially disposed into the space (14) between the first and second block elements.

Regarding claim 15, Killen in Figure 4 discloses a construction element comprising a flexible element (50) having a first surface (surface of 50 in contact with "a" and 20); and a first block element (a) and a second block element (20), the first and second block elements attached to the first surface of the flexible element with a space (14) between the first and second block elements; and a spacer (cables, rods, etc. on Pg 5, Par 101) disposed between the first and second block elements.

Regarding claim 19, Killen discloses a construction element as discussed above and further discloses a material (grouting material, see Pg 5, Par 101) disposed into the space between the first and second block elements.

Regarding claim 20, Killen discloses a construction element as discussed above and further discloses that the material is mortar (Pg 4, Par 94).

Regarding claim 21, Killen in Figure 7 discloses a construction element comprising a flexible element (52) having a first surface (upper surface of 52 adjacent to "a" and 20), the flexible element having a curve, a first block element (a) and a second block element (20), the first and second block elements attached to the first surface of the flexible element with a space (14) between the first and second block elements; and a spacer (cables, rods, etc. on Pg 5, Par 101) placed between the first and the second

block elements to hold the curve. Furthermore, the method set forth in claims 22 and 24 would be inherent in constructing the structure set forth above.

Regarding claim 29, Killen in Figure 4 discloses a construction element comprising a flexible element (50) having a first surface (upper surface of 50 in contact with "a" and 20) and a second surface (lower surface of 50 in contact with 60 and "b"); a first block element (a) and a second block element (20), the first and second block elements (a, 20) attached to the first surface of the flexible element with a space (14) between the first and second block elements; a spacer (cables, rods, etc. on Pg 5, Par 101) disposed between the first and the second block elements; and a third block element (60), the third block element attached to the second surface of the flexible element (50). Furthermore, the method set forth in claims 23 and 25 would be inherent in constructing the structure set forth above.

Regarding claim 30, Killen in Figure 4 discloses a construction element as discussed above and further discloses a fourth block element (b), the third and fourth block element attached to the second surface of the flexible element (50) with a space (16) between the third and the fourth block element.

Regarding claim 31, Killen in Figure 4 discloses a construction element as discussed above and further discloses that the space between the third block element and the fourth block element is filled with a material (grouting material, see Pg 5, Par 101).

Claims 1 and 2 are rejected under 35 U.S.C. 102(b) as being anticipated by Sato (U.S. Patent No. 4,226,060).

Regarding claims 1 and 2, Sato discloses a construction element comprising a flexible element (5) having a first surface (upper surface of 5 in contact with 2); and a first block element (2) having a portion (surface of 2 in contact with 5) of the first block attached to the first surface of the flexible block element and wherein the first block element is a masonry block (Col 2, Ln 40).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Killen.

Regarding claims 9-11, Killen discloses a construction element as discussed above but does not disclose that the space can range from 6.0 centimeters to 0.1 centimeters, 3.0 centimeters to 1.5 centimeters, or 2.0 centimeters to 1.5 centimeters. It would have been an obvious matter of design choice to modify the block of Killen to have the space range from 6.0 centimeters to 0.1 centimeters, 3.0 centimeters to 1.5 centimeters, or 2.0 centimeters to 1.5 centimeters since such a modification would have involved a mere change in the size of the components and would allow for a varying

amount of flexibility to the beam. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

Claims 12, 14 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Killen in view of Flowers (U.S. Publication No. 2004/0003572 A1).

Regarding claim 12, Killen discloses a construction element as discussed above but does not disclose a wedge spacer placed in the space between the first and second block element. However, Flowers discloses a wedge spacer (40) placed in a space (50) between first and second block elements (1, 6). Therefore, it would have been obvious for a person having ordinary skill in the arts at the time of the Applicant's invention to modify Killen to include a wedge spacer placed in the space between the first and second block element as taught by Flowers to provide support and rigidity.

Regarding claim 14, Killen already modified by Flowers discloses a construction element as discussed above and further discloses that the filling material is mortar (Pg 4, Par 94).

Regarding claims 16-18, Killen discloses a construction element as discussed above but does not disclose that the spacer is made of metal or made of an organic material made of plastic. However, Flowers disclose a spacer (40) that can be made out of plastic or metals (Page 2, Par. 26). Therefore, it would have been obvious for a person having ordinary skill in the arts at the time of the Applicant's invention to modify Killen to include a spacer made of an organic material, an organic material made of

plastic or metal as taught by Flowers to provide a material with varying strengths appropriate to an environment in which the blocks will be used.

Annotated Figures

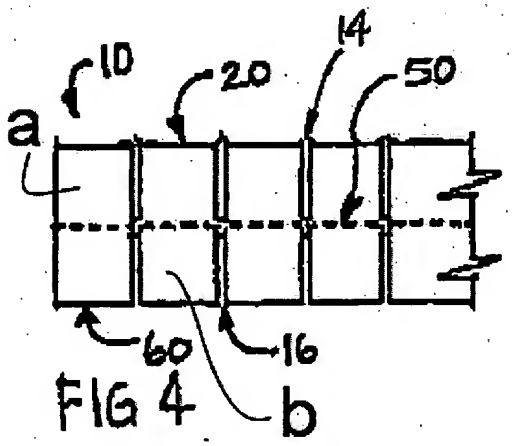


FIG 4

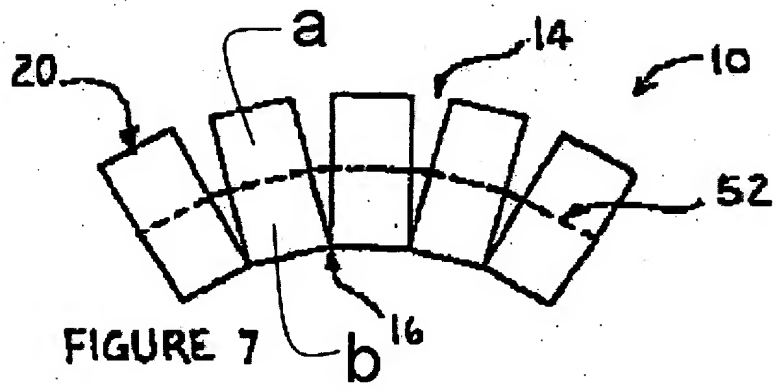


FIGURE 7

Killen (U.S. Publication No. 2004/0128948)

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Wang (U.S. Patent No. 6,794,054 B2) a flexible board; Workups

et al. (U.S. Patent No. 5,640,818) a bendable brick wall; Rosenqvist (GB 2052598 A) a flexible beam; Uniroyal Inc. (AU 424478) a flexible building element.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christine T. Cajilig whose telephone number is (571) 272-8143. The examiner can normally be reached on Monday - Friday from 9am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lanna Mai can be reached on (571)272-6867. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CTC
12/28/06

LANNA MAI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

Notice of References Cited

Application/Control No.	Applicant(s)/Patent Under Reexamination	
10/811,568	MOUNTJOY, RICK	
Examiner	Art Unit	Page 1 of 1
Christine T. Cajilig	3637	

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,226,060 A	10-1980	Sato, Shintaro	52/99
*	B	US-5,640,818 A	06-1997	Wirkus et al.	52/306
*	C	US-2004/0003572 A1	01-2004	Flowers, Dean W.	52/749.13
*	D	US-2004/0128948 A1	07-2004	Killen, Andrew	052/782.1
*	E	US-6,794,054 B2	09-2004	Wang, Wen-Tsan	428/535
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	GB 2052598 A	01-1981	United Kingdom	Rosenqvist, Kalevi	F04C 02/40
	O	AU 424478	08-1986	Australia	Uniroyal Inc.	B 63 c
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

COMMONWEALTH OF AUSTRALIA (11) 424,478

PATENT SPECIFICATION (21) 17,276/67

Class (52) 82.8; 57.2; 70.1; 81.2.

Int. Cl. (51) B63c; B65d; B29d; E04b.

Application Number (21) 17,276/67.
Lodged (22) 6th February, 1967.

Complete Specification entitled (54) IMPROVEMENTS IN RADIAL - FILAMENT SPHERES.

(Application No. 48,137/68 was lodged on 19th December, 1968 as a Divisional of this Application)

Lodged (23) 6th February, 1967.
Accepted (44) 26th May, 1972.
Published (41) 8th August, 1968.

Convention Priority (30) -

Applicant (71) UNIROYAL, INC.

Actual Inventors (72) DANIEL R. ELLIOTT, EDGAR FRANCOIS and DONALD C. MacDONALD.

Related Art (56) 19,504/67 91.6; 82.8; 00.4; 04.7.
43,631/64 70.1
254,132(14,181/62) 91.6; 82.8; 91.2.

The following statement is a full description of this invention, including the best method of performing it known to us :

X402-118-5D-20P.C.

W. C. Marion, Government Printer, Canberra

17.276/67

This invention relates to a method of constructing a hollow, spherical curved shell-type body capable of resisting external pressures and to the body so made.

Hollow bodies capable of withstanding extremely high external pressures are in great demand for oceanographic and various other types of underwater research and exploration, and to serve as the load-carrying envelopes for underwater structures, as vehicles for men and/or instruments, or as buoyant elements for attachment to underwater vessels.

It is known to make such vessels of a solid, integral metal shell and such shells have well-known superior strength characteristics and resistance to buckling under the tremendous compressive stresses to which they are subjected at great depths below the surface of the water. Metallic vessels, however, are disadvantageous in that their strength-to-weight radio is relatively low, while their weight-to-displacement ratio is relatively high.

According to the present invention, there is provided a method of constructing a hollow, spherical body comprising the steps of preparing a number of sheets of thermo-setting resin, reinforced with filaments having a desired or selected modulus of elasticity, the filaments extending from one major planar surface of the sheet to an opposite major planar surface of the sheet substantially normal to the surfaces thereof, the method comprising cutting elements from one or more sheets and assembling the elements into the form of a spherical body with the filaments aligned substantially radially of the body, characterized in that a number of elements are adhered to a backing sheet with the filaments normal to the plane of the backing sheet, the desired number of back-

ing sheets with elements thereon are applied to a mandrel having a spherical or part-spherical surface to form a spherical structure thereon, the backing sheet being on the side adjacent to the mandrel, any spaces between adjacent elements are filled with uncured resin, and the structure is then subjected to a curing treatment for any uncured resin.

displacement. It is capable of withstanding external pressure, and can be made to withstand pressures of up to thousands of pounds per square inch, the limiting pressure being determined to a large degree by the modulus of elasticity of the materials used. Such a body is thus well suited for underwater use.

The body has the further advantage over the previously known metallic vessels that it does not require special polar caps or fittings to permit access to the interior, and can be locally opened and closed as well as repaired by the removal and replacement of relatively small wall sections without impairing vessel strength.

Preferred methods according to the invention will now be described in detail, by way of example, with reference to the accompanying drawings in which:-

Fig.1 is a perspective illustration of a preferred radial-filament sphere constructed of two idential hemispheres;

Fig.2.is a fragmentary vertical section through the sphere shown in Fig.1;

Fig.3 is a perspective elevational view of the basic structural member employed in large numbers in the manufacture of the sphere shown in Figs.1 and 2;

Fig.4 is a similar view of the said member as modified prior to use in the actual build-up of the hemispheres;

Fig.5 is a plan view of the member shown in Fig.4 and illustrates a further structural modification thereof which is effected prior to the hemisphere-building operation;

Fig.6 is an elevational view of a partly built-up hemisphere which when completed is to be used in making the sphere of Fig.1;

Fig.6a is a fragmentary diagrammatic illustration of the manner of building of the hemisphere shown in Fig.6 from the structural members of Fig.5;

Fig. 7 is a diagrammatic illustration of the effect of compressive stresses on a unidirectional or parallel-filament member of the type employed in the body according to the present invention;

Fig. 8 is a perspective illustration of another preferred sphere constructed of two identical hemispheres;

Fig. 9 is a plan view of a built-up intermediate structural member employed in building up the hemispheres used in constructing the sphere shown in Fig. 8;

Fig. 9a is a somewhat enlarged perspective illustration of the starting structural member employed in building up the intermediate member shown in Fig. 9;

Fig. 10 is a side elevational view of the said intermediate member, taken along the line 10-10 in Fig. 9;

Figs. 11 and 12 are schematic elevational views of a hemispherical mandrel and illustrate the first two steps in a further preferred method of building a radial-filament hemisphere;

Fig. 13 is a sectional view taken along the line 13-13 in Fig. 12;

Fig. 14 is an elevational view of the mandrel, similar to Fig. 12, and illustrates the next step of the said method;

Fig. 15 is an elevational view of the mandrel, seen at an angle of 45° to the plane of Fig. 14, and illustrates further steps of this method.

Fig. 16 is a fragmentary diagrammatic illustration of a radial-filament sphere shell and illustrates one of the advantages of bodies produced in accordance with the present invention; and

Fig. 16a is a similar view of a conventional filament-wound sphere shell and illustrates one of the disadvantages of such a construction.

It has been found that when a three-dimensional structure composed of a cured thermosetting resin matrix having embedded therein a multiplicity of parallel unidirectional filaments is subjected to bi-directional compressive stresses normal to the filament orientation, the filaments are stressed in tension. This is diagrammatically illustrated in Fig. 7 wherein B denotes a rectangularly prismatic structure, composed of a cured resin matrix having embedded therein a great number of filaments (not shown) all oriented parallel to each other in the direction of the double-headed arrow F, and subjected to balanced compressive stresses σ' and σ'' which are perpendicular both to each other and to the filament direction. Under such conditions, the filaments are stressed in tension as indicated by the arrows T.

In a hollow spherical vessel subjected to external hydrostatic pressure over its entire surface, the external pressure is opposed by balanced circumferential stresses in the wall of the vessel, and any given element of such a body can thus be considered as being subjected to two perpendicular compressive stresses, both essentially parallel to the surface. The general equation for the circumferential stress in a spherical shell under external hydrostatic pressure is

(1) $$\sigma = \frac{Pr}{2t}$$

where P is the unit pressure, r is the mean radius of the sphere, and t is the wall thickness of the shell. If, now, each such element of the shell body is composed of a unidirectional-filament slab in which all the individual fibres are oriented substantially radially of the sphere and thus normal to the plane of application of the compressive stresses, the fibres in each element of the shell body will be stressed in tension. Thus, no buckling of the filaments can occur, which obviates the requirement of a high degree of straightness

in the fibres and effective lateral support by the resin. It will be readily recognized that this is precisely opposite to the situation existing in conventional filament-wound spheres, where transverse buckling of the filament windings is resisted only by the lateral support provided by the resin.

It can be shown that the critical pressure P_c for the buckling of a spherical shell of wall thickness t and radius r is

(2) $$P_c = k \frac{E}{\sqrt{(1-\nu^2)}} \left(\frac{t}{r}\right)^2$$

where E is the modulus of elasticity, ν is Poisson's ratio, and k is an empirically determinable numerical constant. Deep submergence vessels are also generally characterized by a figure of merit M which is defined by the relation

(3) $$M = \frac{W}{D}$$

where W is the weight of the vessel, and D is the weight of the water displaced thereby. For a given value of the critical pressure for buckling, the quantity W/D, which is the weight-to-displacement ratio, is related to the nature of the material of which the vessel is made by the proportionality.

(4) $$\frac{W}{D} \sim \frac{\rho}{E}$$

where ρ is the density of the wall material. It will be evident that a low value for the ratio W/D represents a large payload capability for the vessel, and from equation (1) that the wall thickness t should be in direct proportion to the radius of the vessel, so that vessels of different sizes will have the same pressure capabilities.

From equations (2) to (4) it can be seen, therefore, that for a sphere of a given size and intended for a specified critical pressure, better performance (lower W/D) results from a higher modulus E, which permits a decreased wall thickness t, and from a lower density ρ. Effective implementation of the principles

of the present invention thus entails the use of unidirectional fibre and resin building elements having an optimally low value of f/E, a ratio which decreases as E increases, E in this case being the transverse modulus of elasticity of the element (i.e. the modulus perpendicular to the filament direction). It is preferred to employ both resin and fibre components of high modulus, since both contribute to the transverse modulus of the composite element. Nevertheless, it will be understood that other factors, e.g. permissible density, weight, etc., may place limitations on the choice of resin and/or fibre for the elements.

Merely by way of example, we have found that excellent results are achieved by using glass filaments (having a modulus of elasticity in the range of about 10,000,000 to 12,500,000 psi) as the fibre component in a resin matrix composed of an epoxy resin system marketed by Minnesota Mining and Manufacturing Company under the designation "1009" (having a modulus of about 430,000 psi). Alternatively, the fibre component of the building elements may include asbestos fibres (modulus in the range of about 24,000,000 to 25,000,000 psi), boron filaments (modulus in the range of about 50,000,000 to 60,000,000 psi), carbon filaments (modulus in the range of about 20,000,000 to 70,000,000 psi), sapphire whiskers, tungsten whiskers, etc. The resin component may be an epoxy resin such as any of those marketed by Union Carbide Corporation under the designations "ERL-2256" (modulus about 550,000 psi), "ERRA-0300" (modulus about 720,000 psi) and "EP-2114" (modulus about 1,030,000 psi), as well as other such resins, and various other synthetic resins such as phenolic resin, melamine resin and the maleic alkyd/styrene copolymer types of polyester resins, characterized by relatively low values of f/E. We have found, for example, that an element such as shown in Fig. 7 and composed of an epoxy resin matrix (Minnesota Mining and Manufacturing Company's type "1009")

having embodded therein unidirectional filaments of "S" glass (77% of the total volume) can withstand balanced compressive stresses of 165,000 psi in each of the σ' and σ'' directions.

Figs. 1 and 2 show a hollow sphere 25 constructed of two hemispheres 25a and 25b each built up in accordance with the present invention. The method here employed, which we term the "lune" method, uses as the starting material a procured unidirectional sheet composed of a resin matrix, e.g. epoxy resin, and glass or other filaments embedded therein, the filaments extending parallel to each other and to the wide faces of the sheet. The sheet is first severed into a plurality of thin strips 26 (Fig.3), the direction of cutting being perpendicular to both the direction of the filaments and the plane of the sheet. Each strip 26 thus has a multitude of short, closely packed filament lengths extending perpendicularly to its wider faces, as indicated diagrammatically at 26a. The thickness of the strips 26 will, of course, depend on the intended structural and strength characteristics of the sphere to be constructed.

Each strip 26 is then cut into a section 27 having the shape of a half-lune (Fig. 4), and an adhesive tape 28 having a pressure-sensitive adhesive on each face thereof is applied to one face of each half-lunate section 27. As the final preparatory step, each half-lunate section 27 is cut into elements 27a in a rectangular grid pattern (Fig. 5), severing it to, but not through, the adhesive tape backing. The elements 27a thus remain adhered to the backing tape, and the assembly thereby has a two-dimensional formability, i.e. the ability to bend both longitudinally and transversely.

The manner in which the various half-lunate sections 27 are built up into the form of a hemisphere 25a (or 25b) is

best shown in Figs. 6 and 6a. The only equipment required for this operation is a destructible spherical mandrel 29 of the appropriate outer diameter, made conveniently of a low-melting alloy, e.g. Wood's metal. As is clearly apparent, the building method involves laying the individual half-lunate sections onto the mandrel with their respective adhesive tape backings in contact with the mandrel. Thus, each half-lunate section is applied to the mandrel by initially positioning the wide end 27b parallel to the "equator" of the mandrel, as indicated in solid lines in Fig. 6a, and then bending the strip over into its final, curved, mandrel-conforming position, as indicated in broken lines in Fig. 6a, so that the apex 27c of the half-lunate section essentially reaches the "pole" of the mandrel. It should be understood that in actual practice it will be preferable to use half-lunate sections 27 of such sizes that when they are adhered to the mandrel, their wider ends 27b are located slightly below the mandrel "equator", for a reason which will become clear as the description proceeds.

After this building operation has been completed, the assembly is vacuum-impregnated on the mandrel with an appropriate thermosetting resin, e.g. epoxy resin, to fill the respective spaces between adjoining half-lunate sections and between adjoining elements 27a, and is cured on the mandrel to complete the setting of the filling resin. Thereafter, the mandrel is removed, as by melting it out, and the interior of the hemisphere is cleaned, at which time the tape 28 is also removed. The annular equatorial surface of the hemisphere is then cut and ground true, so it can mate with another like hemisphere. Two identical hemispheres are finally equatorially joined together by means of an epoxy resin adhesive, for example that marketed by Shell Oil Company under the designation EPON-934. The so-assembled sphere is then again subjected to a curing operation to set the adhesive.

For a radial-filament sphere of this type, having a 3-inch inner diameter, we have found a wall thickness of 0.180 inch (the component stripe being transversely cut to that thickness from a $\frac{3}{8}$ inch thick unidirectional sheet of epoxy-bonded glass filaments obtained from the Minnesota Mining and Manufacturing Company and available in various thicknesses) to be sufficient to provide a collapse pressure in excess of 13,000 psi at a weight-to-displacement ratio of 0.53. A comparable filament-wound and internal ring-stiffened construction having a collapse pressure of 13,600 psi is found to have a weight-to-displacement ratio of 0.62, the increase of about 17% in weight representing a correspondingly reduced payload capability.

A somewhat different method, herein termed the "1/3 octant" method, of building a radial-filament sphere from unidirectional resin and filament sheets is illustrated in Figs. 8 to 10. As before, a sphere 30 (Fig. 8) may be constructed by joining two identical hemispheres 30a and 30b. Each hemisphere is, however, made up of four quadrant sectors 31, each of which is an octant of a sphere, and each quadrant of the hemisphere is made up of three substantially identical, four-sided, spherically curved sections 32 (see also Figs. 9 and 10) each having a one-third octant shape the area and contours of which can be easily calculated from known geometrical considerations.

As the first step of the preferred hemisphere-building method according to this aspect of the present invention, a number of elongated planar strips 33 (Fig. 9a) somewhat greater than the number required for the one-third octant section 32 to be formed are assembled in side-by-side relation and clamped together against a flat surface, with the fibres oriented normal to said surface. A thin sheet 34 of rubber or other flexible material capable of being formed smoothly over a doubly curved surface is then cemented to the entire exposed

face of this assembly of strips. The assembled strips are then cut transversely to their lines of juncture, down to but not through the flexible sheet 34, resulting in the formation of a relatively large number of small elements 33a which are cemented only to the rubber sheet but not to each other. This section is then laid onto a spherically curved mandrel of proper radius (with the sheet 34 against the mandrel surface) and is impregnated with epoxy resin to fill the numerous essentially V-shaped cracks between the elements. After the resin filling is cured, the section is cleaned of the sheet backing and excess resin, and cut and trimmed to the exact contours of a one-third octant as shown in Fig. 9. Three such cured sections 32 are then assembled on a hemispherical mandrel and fitted together to constitute an octant 31 of the sphere, and epoxy resin is applied to the mating or abutting surfaces of the sections and cured to complete the octant. Four such octants, properly trimmed, are assembled on a spherical mandrel, and epoxy resin is applied to their mating surfaces and cured, to complete the hemisphere (30a or 30b). Two such hemispheres are thereafter equatorially joined as before by an epoxy resin bond to complete the sphere.

Yet another preferred method of building a hollow sphere according to the present invention is illustrated in Figs. 11 to 15. In this method, herein termed the "strip" method, elongated strips 35 of unidirectional elements are employed, each strip consisting of an end-to-end arrangement of a number of such elements adhered at one face to a double-faced, pressure sensitive adhesive tape 37 (similar to the tape 28 shown in Figs. 2, 4 and 6). The filaments are, as before, perpendicular to the tape backing. The method involves first forming an equatorial region, one or more strips in width, along the "equator" of the spherical mandrel 29 (Fig. 11), the strips 35

being secured to the mandrel by the tape. Thereafter, one or more strips 35a are laid along a great circle path across the "pole" of the mandrel, joining two diametrally opposite sections of the uppermost edge of the topmost equatorial strip 35 (Figs. 12 and 13). Two quarter-circle strips 35b are then laid onto the mandrel, spaced 90° from strips 35a and extending from opposite sides of polar strips 35a down to the corresponding diametrally opposed sections of the upper edge of the topmost equatorial band 35 (Fig.14). At this stage, therefore, there are still open four spherically triangular sections of the hemisphere. These are then filled in progressively by applying further strips 35c etc. (Fig.15) cut to suitable shape where they meet corners of the respective triangles. It is again noted that in actual practice the lowermost strip 35 will preferably extend somewhat below the "equator" of the mandrel 29. After the hemisphere has been completed in this manner, the cracks are filled in with epoxy resin as previously described, and the entire assembly is cured and, after removal of the mandrel and the tape, machined accurately in the equatorial plane. A complete sphere is then formed, as above, by cementing two such hemispheres to each other along their equatorial edges.

Despite differences in the various above-described methods of construction, all spheres built up in accordance with the principles of the present invention will perform substantially equally well under identical environmental conditions, subject to the qualification that the presence of the resin-filled V-joints or spaces between adjoining elements in the spheres produced by the "lune", "1/3-octant" and "strip" methods of construction reduces slightly the critical pressure of the shell. It will be apparent, however, that such V-spaces may be filled with tapered pieces of unidirectional fibre-

reinforced resin cut from the same material as the other elements, which pieces would be cemented in place with the fibre lengths therein also oriented substantially radially of the sphere, whereby the aforesaid slight decrease in critical pressure could be avoided. In any event, the effectiveness of all these spheres in sustaining extremely high external pressures stems directly from the radial orientation of the filaments which provides strength and elastic stability far beyond those of conventional filament-wound constructions. Stated in other words, the radial filaments in the body according to the present invention are circumferentially isotropic, i.e. they are equally effective in all circumferential directions, whereas in conventional filament-wound structures a given filament provides support primarily in a single direction, which makes it approximately one-half as effective as the filaments in the structures according to the present invention.

It should also be noted that the uncured unidirectional filament and resin material, which is used to make the basic building elements of the spheres, generally may be relatively resin-rich (resin about 35 to 50% of the total volume) and thus has a maximum filament content of about 65%. We have found it advantageous, however, to use a filament content above about 65% and preferably in the range of about 75 to 90% of the total volume. This condition can be readily achieved by squeezing out some of the resin from the uncured material prior to the curing thereof. The reason is that with a higher filament content in the shell wall, the sphere can withstand higher external hydrostatic pressures. Nevertheless, the principles of the present invention can also be implemented by using the original material of unreduced resin content, it being understood that the critical pressure rating of a sphere

so produced will be somewhat lower than that of a sphere having a reduced resin content and thus an increased fibre content.

As an example of the present invention, we have constructed a radial-filament sphere 3 inches in diameter, by the method of Figs. 11 to 15 described herein, from epoxy resin sheet reinforced with fibreglass filaments, the resin having a modulus of elasticity of 430,000 psi and the glass of modulus 12,400,00 psi (supplied by Minnesota Mining and Manufacturing Company under the designation 1009-29A). The volume fraction of filaments present in the sphere was 77% and the sphere had a weight-to-displacement ratio (W/D) of 0.50. In actual tests, this sphere sustained an external hydrostatic pressure of 25,000 psi without failure.

Still further advantages of the body according to the present invention will become evident from a consideration and comparison of Figs. 16 and 16a of the drawings. Thus, as shown in Fig. 16, in a radial-filament spherical shell 49 it is possible to provide a port opening 50 with radial boundary surfaces, as indicated by the broken lines 50a and 50b. Since the filaments are substantially radially oriented, the port opening can be formed by cutting a segment of suitable size directly out of the shell wall without introducing any end-loading stresses, and without any need to provide means for preventing failure of the structure by spreading or delamination of the wall. By way of contradistinction, as shown in Fig.16a in a conventional filament-wound spherical shell 51 the provision of a port opening 52, even with radial boundary surfaces, entails cutting across the filaments, which automatically introduces end-loading stresses and makes it imperative to provide supporting flanges at the opening to prevent failure by spreading or delamination. From this it will be appreciated that in the event a portion of a radial-filament sphere is damaged, it is possible to repair the same quite easily, since

it is necessary simply to cut out the damaged portion with an identical mating radial-filament section which can be cemented in place to repair the shell without loss of strength. It will be equally evident that this type of repair is impossible in a conventional filament-wound shell since the severed filaments around the damaged area cannot be reconnected.

Yet another advantage of the body of the present invention is that a sphere of this type need not be provided with polar end fittings or caps to provide access to the interior of the sphere. Especially where the sphere is initially constructed of two identical hemispheres, it is possible to insert the payload, e.g. the instruments and/or other materials, into one of the hemispheres prior to the cementing thereof to the other hemisphere for completion of the sphere, whereby the entire interior of the sphere is available for payload. This is essentially impossible in a filament-wound sphere which at all times requires the provision of generally metal polar caps or fittings to provide access to the interior of the sphere, and since a filament-wound sphere can only be formed as an entity, the polar openings therein must of necessity be relatively small, limiting the degree of access obtainable and concomitantly limiting the sizes and character of instruments which can be inserted into the sphere to width dimensions less than the diameter of such openings. In addition, the need for metal polar fittings in a filament-wound sphere increases its weight-to-displacement ratio which, as previously mentioned, decreases its payload capability in corresponding degree.

17,276/67

The claims defining the invention are as follows:-

1. A method of constructing a hollow, spherical body comprising the steps of preparing a number of sheets of thermosetting resin, reinforced with filaments having a desired or selected modulus of elasticity, the filaments extending from one major planar surface of the sheet to an opposite major planar surface of the sheet substantially normal to the surfaces thereof, the method comprising cutting elements from one or more sheets and assembling the elements into the form of a spherical body with the filaments aligned substantially radially of the body, characterized in that the number of elements are adhered to a backing sheet with the filaments normal to the plane of the backing sheet, the desired number of backing sheets with elements thereon are applied to a mandrel having a spherical or part-spherical surface to form a spherical structure thereon, the backing sheet being on the side adjacent to the mandrel, any spaces between adjacent elements are filled with uncured resin, and the structure is then subjected to a curing treatment for any uncured resin.

2 A method according to claim 1 in which the backing sheet is applied to the sheet material before this is cut into elements.

3 A method according to claim 1 or claim 2 in which the elements are formed by cutting the sheet material in a rectangular grid pattern.

4 A method according to any one of the preceding claims in which the sheet material is cured before it is cut to form the elements.

5 A method according to any one of the preceding claims in which the backing sheet is a double-faced pressure-sensitive adhesive tape.

6 A method according to any one of claims 1 to 4 in which the backing sheet is a sheet of flexible material

17.276/67

and is secured to ~~the face of~~ the sheet material or elements cut therefrom by cementing.

7 A method according to any one of the preceding claims in which a hemispherical body is assembled on a spherical mandrel, and is subsequently bonded by resin to a similar hemispherical body, the resin then being cured to result in an integral sphere.

8 A method according to any one of the preceding claims in which the sheet material is cut to form half-lunate sections, backing sheets are applied to one surface of the sections, the sections are cut into elements in a rectangular grid pattern and the backing sheets bearing the cut sections are applied to a spherical mandrel, the wider ends of the sections lying on the equatorial line of the mandrel and the points of the sections meeting at the pole of the mandrel, to form a hemisphere.

9 A method according to any one of claims 1 to 7 in which sheet material is applied to a backing sheet and cut into elements in a rectilinear grid pattern and is then ~~this assembly is~~ cut to form a section of roughly one-third octant shape, the section is placed on a spherical mandrel with the backing sheet contacting the mandrel, the spaces between the elements are filled with resin which is then cured, and the section is then trimmed to an exact one-third octant; subsequently three such one-third octant sections are secured together by resin on a further mandrel to form octants, the resin then being cured, and four of the resultant octants are assembled into a hemisphere, the wide end of each octant lying on the equatorial line of a mandrel, and the narrow ends thereof meeting at the pole.

10 A method according to any one of claims 1 to 7 in which strip-form sections of sheet material have a backing sheet applied thereto and are then cut across their width

to form a series of elements adhering to the backing sheet, and a hemisphere is built up on a spherical mandrel by first applying at least one strip to the mandrel as an equatorial band, then at least one strip over the pole of the mandrel from one edge to the diametrically opposite edge of the equatorial band, then at least one strip on each side of the polar band extending transversely thereto to the edge of the equatorial band, and finally angularly directed strips within each of the spherical triangles previously defined on the mandrel surface until the triangles are completely filled.

11. A hollow spherically curved shell-type body constructed by a method according to any one of the preceding claims.

DATED THIS 17TH DAY OF DECEMBER, 1968
UNIROYAL, INC.

Agent for the Applicants.
EDWD. WATERS & SONS,
30 RUSSELL STREET,
MELBOURNE. VIC. 3000.

17.27 6 167

FIG. 1

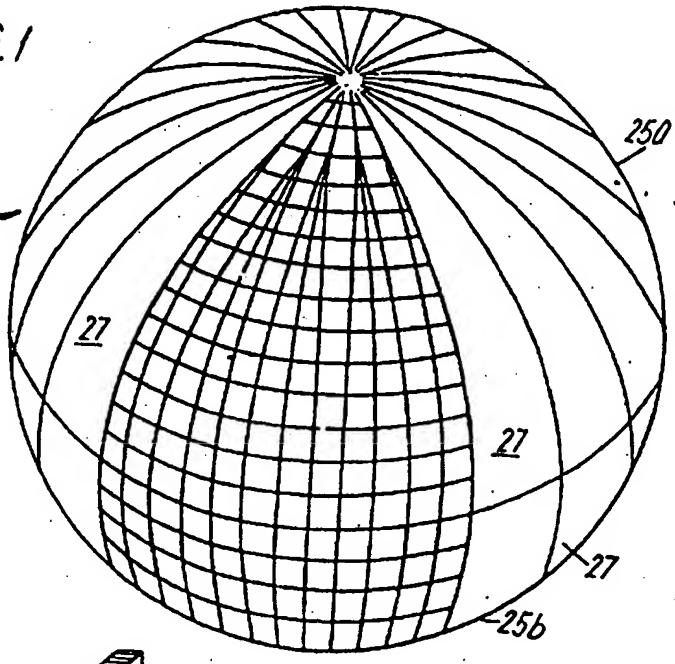
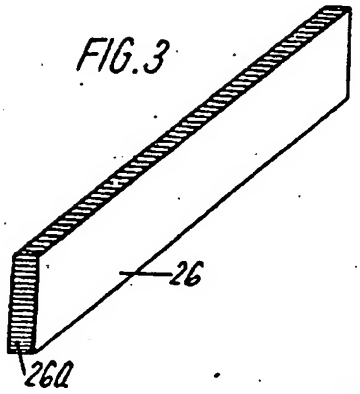


FIG. 3



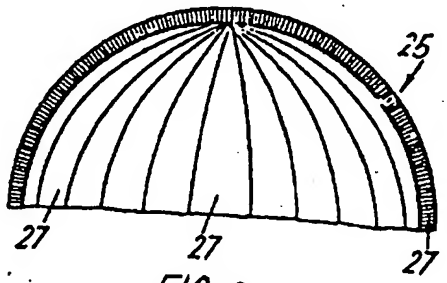
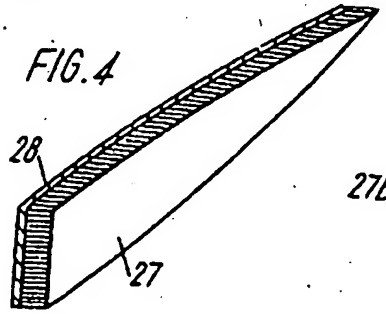


FIG. 2

FIG. 4



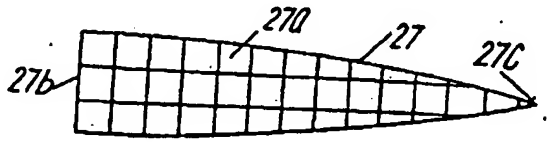
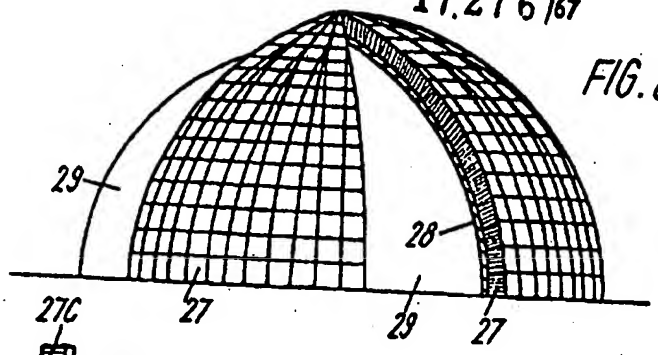


FIG. 5

17.276/67

FIG. 6



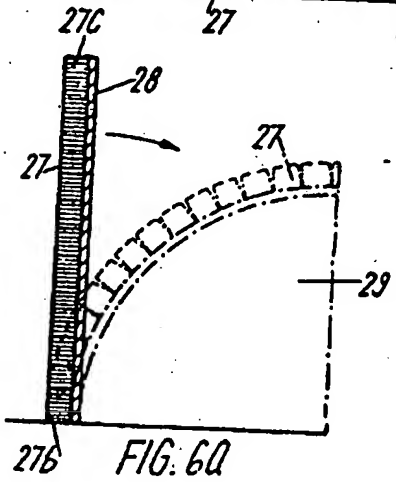
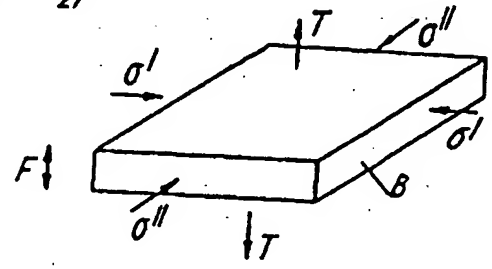


FIG. 6a

FIG. 7



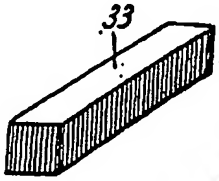


FIG. 9a

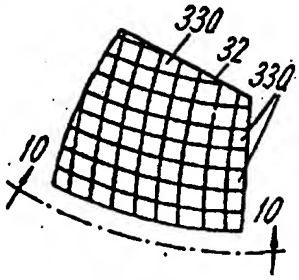


FIG. 9

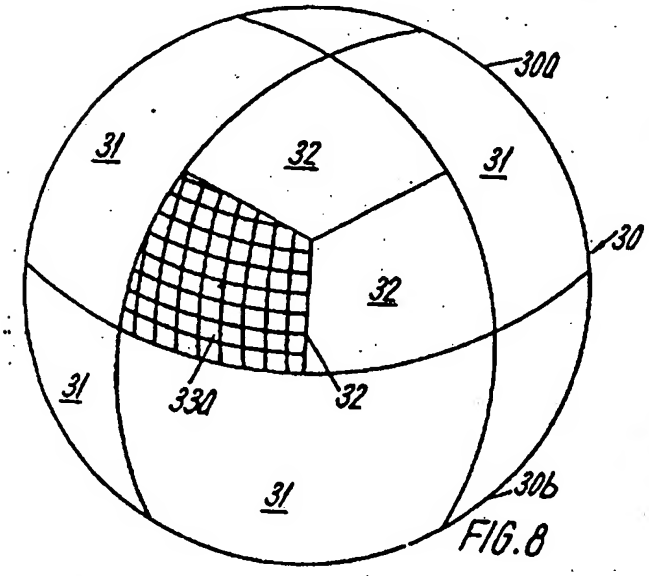


FIG. 8

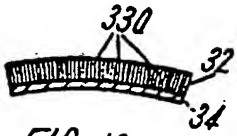


FIG. 10

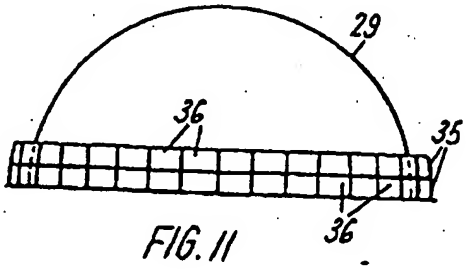


FIG. 11

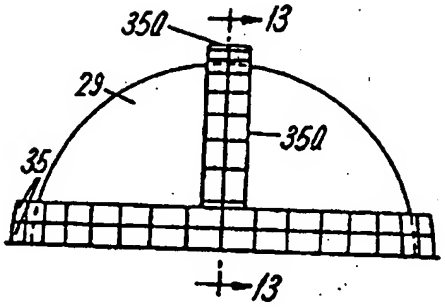


FIG. 12

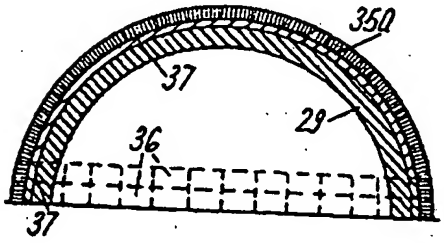


FIG. 13

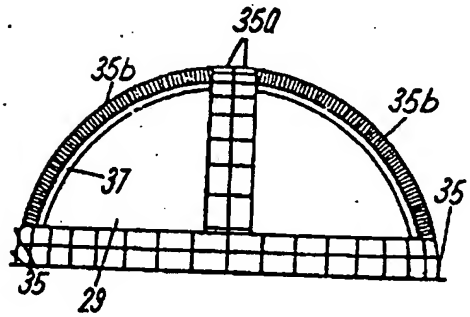


FIG. 14

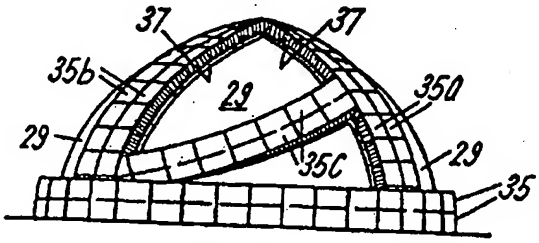


FIG. 15

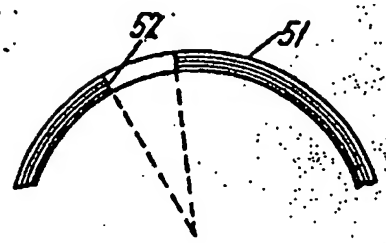


FIG. 16a

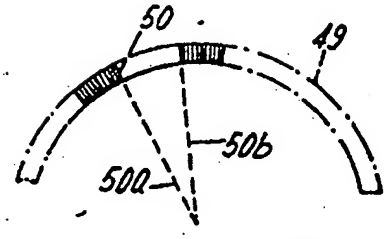


FIG 16

(12) UK Patent Application (19) GB (11) 2 052 598 A

(21) Application No 8015293
(22) Date of filing 8 May 1980
(30) Priority data
(31) 79/16447
(32) 11 May 1979
(33) United Kingdom (GB)
(43) Application published
28 Jan 1981
(51) INT CL³
E04C 2/40
(52) Domestic classification
E1D 155 2141 302 314
372 LEC LES2
(56) Documents cited
GB 2009280A
GB 1294651
GB 1245391
GB 320143
(58) Field of search
E1B
(71) Applicant
KR Rakenne Oy,
Aurorankatu 5 A 7, 00100
Helsinki 10, Finland
(72) Inventor
Kalevi Rosenqvist
(74) Agent
Stanley, Popplewell,
Francis & Ross

(54) **Building Dressing Board**

(57) A building dressing board is provided which is flexible and relatively light in weight by virtue of a relatively thin backing or body part (which may be of concrete) to which are affixed surface members (shown as plates—of brick, clinker, concrete or other rigid material) so arranged that grooves are formed between them, and by virtue of the flexibility of a reinforcing or bonding material which bridges the grooves and is elsewhere embedded in the backing or body part. The reinforcing material may be of metal (e.g. galvanised sheet steel) reticulated where embedded but intact where it bridges the grooves and serves for fixing the building board to a building structure (e.g. by means of screws or by welding.) After the fixing the grooves are filled with a jointing substance, so that a concealed fixing of the board is accomplished. The surface members and the backing or body part may, if desired, be formed integrally of one and the same material.

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

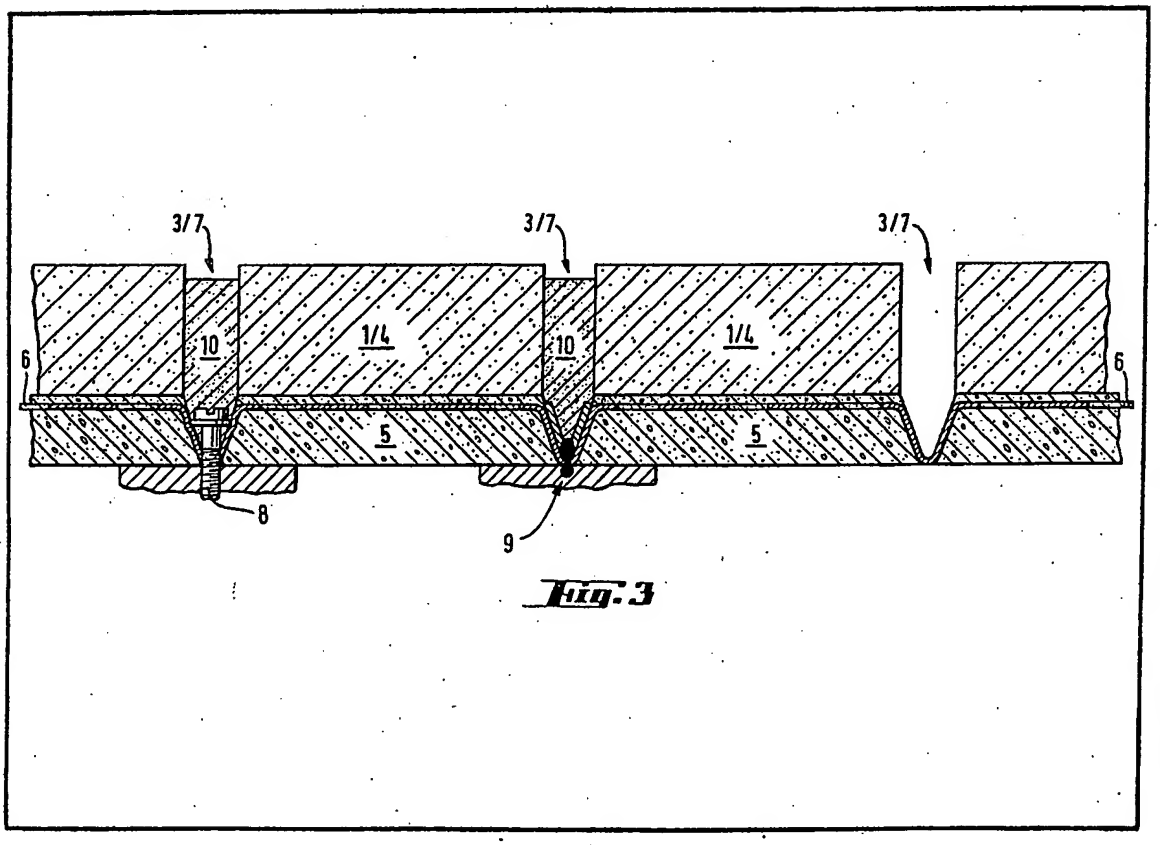


Fig. 3

GB 2 052 598 A

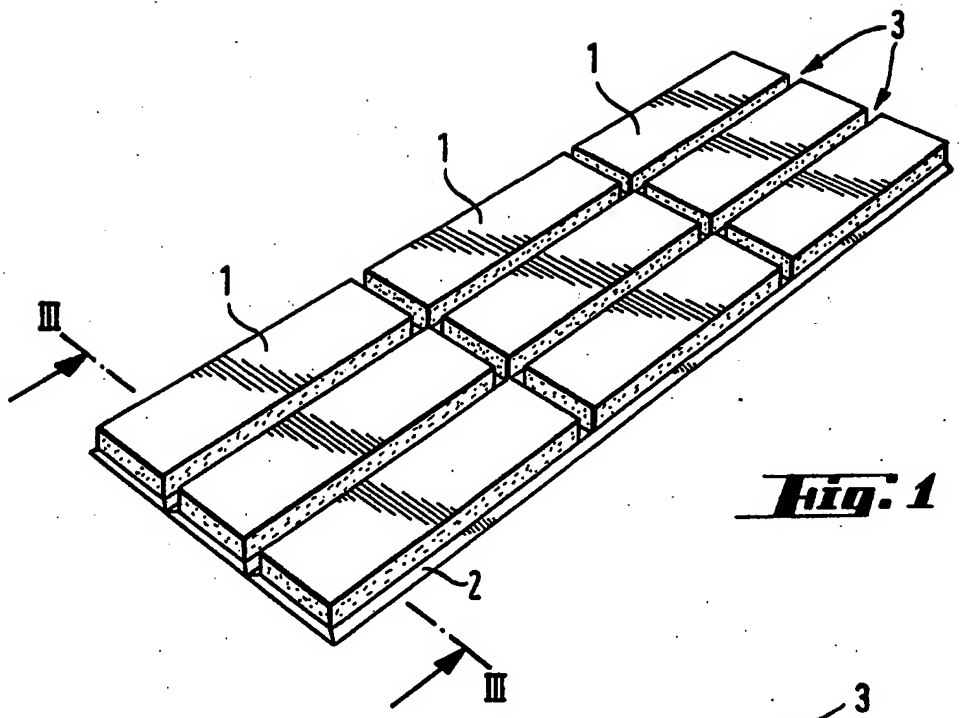


Fig. 1

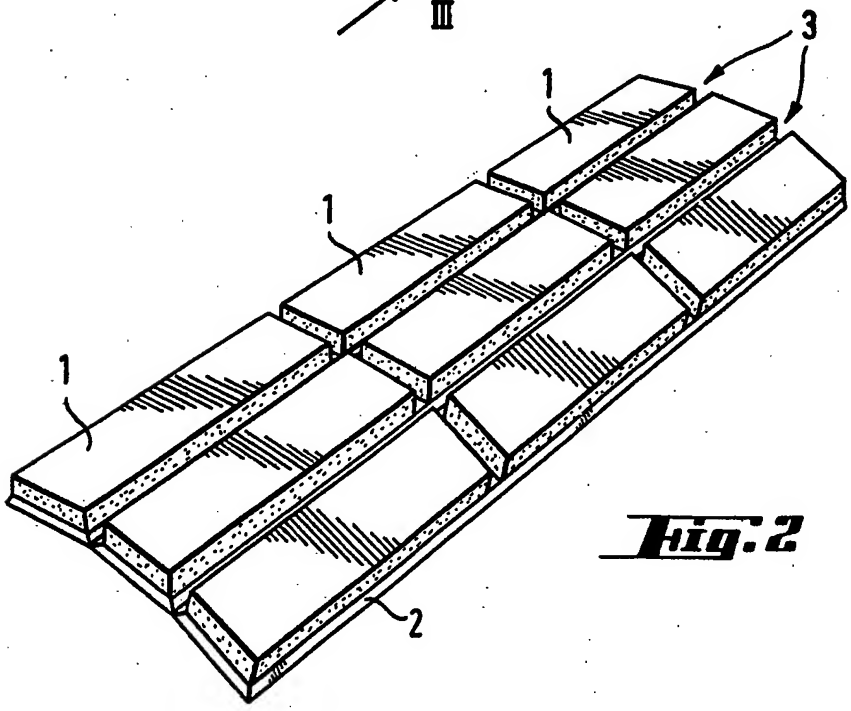


Fig. 2

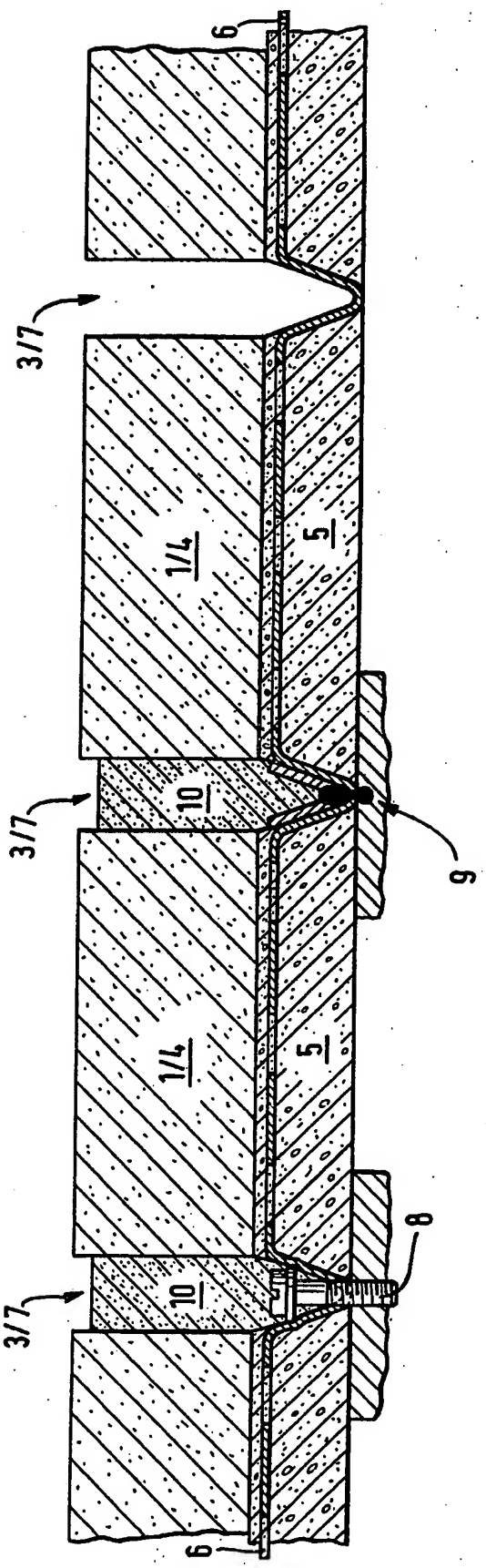


Fig.3

SPECIFICATION

Building Dressing Board

The present invention concerns a building dressing board comprising surface members of brick, clinker or other rigid material.

In prior art several different building boards made of concrete and brick are known. Usually these are large boards with the size of a whole wall. The manufacturing of such boards implies, among other things, the use of steel reinforcements conforming to the concrete standards. It is due to the size and mass of known boards that their mounting is difficult and implies the use of cranes or equivalent equipment. The fixing of known boards is also inconvenient, inasmuch as they are usually fixed by welding and grouting.

The building boards of prior art are also completely rigid. Therefore they cannot be bent to form curved surfaces. From the rigidity of the boards also arises the drawback that stresses are easily set up in the boards and as their results, cracks appear—in particular in the case of thin boards.

An object of the present invention is to provide a new type of building dressing board by the aid of which the above-described drawbacks, among others, can be avoided. The dressing board of the invention is characterized by the circumstances set forth in claim 1.

The greatest advantages of the information can be observed to be the following. The dressing board of the invention has a light weight and it is easy to mount by human labour. Curved surfaces may also be built with it. The board also is not sensitive to stress cracks. Fixing of the board is feasible to virtually any base. The range of use of the board of the invention is also exceedingly broad, since it is usable on all and any surfaces of a building.

In the following, the invention and the other advantages gainable with its aid are described in detail, with reference to the attached drawings.

Fig. 1 presents one embodiment of the invention, in perspective.

Fig. 2 shows the board of Fig. 1, bent to a curved shape.

Fig. 3 shows the cross section of a board embodying the invention.

The building dressing board shown in Fig. 1 comprises an outer surface composed of a plurality of surface members, here shown as plates 1. The surface plates consist most appropriately of brick, clinker, mosaic or concrete. The surface plates 1 have at the manufacturing state been affixed to a backing or body part 2 in such manner that there remain grooves 3 between the surface plates. Within the body part 2 has been disposed a reinforcing or bonding material, which shall be more closely explained later on.

As shown in Fig. 2, the board of the invention may be angulated at the grooves 3. The angulation (bending) is rendered possible by the bonding material and by the way in which it has been disposed in the body part 2. This is more closely illustrated by Fig. 3. In Fig. 3, the surface plates have been indicated with the reference numerals 4 and the body part with 5. Within the body part 5 has been disposed a reticular reinforcing or bonding sheet 6 made by machining of preferably galvanized steel sheet. The bonding sheet 6 presents intact metal at each groove 7. Furthermore, there has been provided a V-shaped fold at each groove 7, whereby the metal extends virtually down to the surface of the body part 5 in each groove 7.

When the board is bent to an angle along one of the grooves 7, the bonding material 6 operates as a hinge between the different parts of the board. Even if thereby the metal were exposed, there is no risk of corrosion because the metal sheet is galvanized or protected against corrosion in another way.

Fixing of the board may be accomplished in one of many ways. Fig. 3 presents two different modes of fixing, although naturally only one mode of fixing at a time will be used. The board may be fixed, as shown in Fig. 3, by means of screws 8. The metal sheet 6 may be pre-perforated at the V-shaped folds to the purpose of fixing.

Fixing of the board may also be accomplished by welding if the board is affixed to a suitable metallic base. The fixing by welding is illustrated at 9 in Fig. 3. In that case, a bent, thicker metal piece is placed in the V-shaped groove 7, this metal piece having a hole in its centre. Through this hole the piece is welded to the base, whereby at the same time the board will be fixed to the base.

The fixing of the board completed, the grooves 7 are filled with a jointing substance 10. The jointing carried out afterwards enables individual jointing to be done in each particular instance.

The design of the invention just described enables the board to be made comparatively thin and light. In practice, the appropriate thickness of the backing or body part is usually between 10 and 50 mm.

In the foregoing, the invention has been described with reference being made to one favourable embodiment example only, but it is to be understood that the invention may be modified in numerous ways within the scope of the claims following below. For instance, the concrete of the backing or body part may be replaced with an equivalent material which binds the surface members and the bonding material 6 to one integral board. As such materials, plastic resins for instance may be contemplated.

It is furthermore possible to make the surface members and the backing or body part of one and the same material, in which case there are no separate surface plates; instead, equivalent grooves are formed in the body part.

Claims

1. A building dressing board comprising surface members of brick, clinker, concrete or

another rigid material, a relatively thin body part and a bonding material disposed within said body part,

the surface members being so arranged that between them grooves are formed, at the bottom of which a concealed fixing of the board can be accomplished;

and the bonding material being so disposed within the body part that at least at one of the said grooves it extends either all the way down to the surface of the body part or at least close to the surface.

2. Dressing board according to claim 1, characterized in that the bonding material consists of netting made of sheet metal and of which the parts extending close to the surface of the body part consist of intact metal sheet.

3. Dressing board according to claim 2, characterized in that the sheet metal is galvanized steel.

4. Dressing board according to any one of the preceding claims, characterized in that at the site of each of the said grooves there is formed in the bonding material a V-shaped groove, as seen in the direction of the cross section of the board.

5. Dressing board according to any one of the preceding claims, characterized in that the thickness of the body part is between 10 and 50 mm.

6. Dressing board according to any one of the preceding claims, characterized in that the surface plates have been formed of the same integral material as the body part.

7. A building dressing board substantially as herein described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1981. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/811,568	MOUNTJOY, RICK
Examiner	**Art Unit**
Christine T. Cajilig	3637

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	12/28/06
	1	√
	2	√
	3	√
	4	√
	5	√
	6	√
	7	√
	8	√
	9	√
	10	√
	11	√
	12	√
	13	√
	14	√
	15	√
	16	√
	17	√
	18	√
	19	√
	20	√
	21	√
	22	√
	23	√
	24	√
	25	√
	26	N
	27	N
	28	N
	29	√
	30	√
	31	√
	32	
	33	
	34	
	35	
	36	
	37	
	38	
	39	
	40	
	41	
	42	
	43	
	44	
	45	
	46	
	47	
	48	
	49	
	50	

Claim		Date
Final	Original	
	51	
	52	
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
	62	
	63	
	64	
	65	
	66	
	67	
	68	
	69	
	70	
	71	
	72	
	73	
	74	
	75	
	76	
	77	
	78	
	79	
	80	
	81	
	82	
	83	
	84	
	85	
	86	
	87	
	88	
	89	
	90	
	91	
	92	
	93	
	94	
	95	
	96	
	97	
	98	
	99	
	100	

Claim		Date
Final	Original	
	101	
	102	
	103	
	104	
	105	
	106	
	107	
	108	
	109	
	110	
	111	
	112	
	113	
	114	
	115	
	116	
	117	
	118	
	119	
	120	
	121	
	122	
	123	
	124	
	125	
	126	
	127	
	128	
	129	
	130	
	131	
	132	
	133	
	134	
	135	
	136	
	137	
	138	
	139	
	140	
	141	
	142	
	143	
	144	
	145	
	146	
	147	
	148	
	149	
	150	

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
10/811,568	MOUNTJOY, RICK	
Examiner	**Art Unit**	
Christine T. Cajilig	3637	

SEARCHED			
Class	Subclass	Date	Examiner
52	89	11/6/2006	CTC
	223.9	10/31/2006	CTC
	86	11/6/2006	CTC

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Search from Michael Safavi (Class 52)	10/31/2006	CTC
PALM Inventor search	12/28/2006	CTC
EAST forward/backward search (See Search History)	11/6/2006	CTC

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	3	("4704754"|"5060426"|"5444948").PN.	US-PGPUB; USPAT	OR	ON	2006/12/28 13:42
S2	114	(52/223.9).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2006/12/28 14:43
S3	1026	(52/245).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2006/10/30 09:01
S4	855	(52/604).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2006/10/30 09:17
S5	700	(52/596).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2006/11/06 16:46
S6	603	(52/604).CCLS.	US-PGPUB; USPAT	OR	OFF	2006/10/30 09:22
S7	3061	("52"/$.ccls. "428"/$.ccls.) AND ((block module) WITH (flex$4 bend$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 09:26
S8	624	S7 AND ((layer) WITH (flex$4 bend$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 09:27
S9	1729	("52"/$.ccls.) AND ((block module) WITH (flex$4 bend$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 11:59
S10	171	S9 AND ((layer) WITH (flex$4 bend$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 09:27

EAST Search History

S11	657	("52"/$.ccls.) AND ((spacer wedge) with (space gap) with (in inserted insert))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 12:35
S12	52	S11 and ((grout mortar) with (space gap))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 12:23
S13	249	S11 AND ((spacer wedge) with (metal plastic))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/10/30 12:35
S15	199	(52/89).CCLS.	US-PGPUB; USPAT	OR	OFF	2006/11/06 17:05
S16	9	(52/89).CCLS.	EPO; JPO; DERWENT	OR	OFF	2006/11/06 17:04
S17	351	(52/89).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2006/11/06 17:11
S18	4	S17 and ((lift lifting hoist hoisting) with (ends center))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:13
S19	1068	(52/86).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2006/11/06 17:12
S20	1033	S19 NOT S17	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:12
S21	660	(52/86).CCLS.	US-PGPUB; USPAT	OR	OFF	2006/11/06 17:12
S22	634	S21 NOT S17	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:12
S23	29	S22 and ((lift lifting hoist hoisting) with (ends center))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:17

EAST Search History

S24	11	S22 and ((lift lifting hoist hoisting) with (arch))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:13
S25	0	S22 and ((lift lifting hoist hoisting) with (leg) with (arch))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:17
S26	2	S22 and ((lift lifting hoist hoisting) with (leg))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:18
S27	7	(52/745.2.ccls. 52/745.08.ccls. 52/745.07.ccls.) and ((lift lifting hoist hoisting) with (leg end) with (arch))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:21
S28	13	(52/745.2.ccls. 52/745.08.ccls. 52/745.07.ccls. 52/86.ccls. 52/89.ccls.) and ((lift lifting hoist hoisting) with (leg end) with (arch))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:26
S29	17	(52/745.2.ccls. 52/745.08.ccls. 52/745.07.ccls. 52/86.ccls. 52/89.ccls.) and ((erect erecting) with (leg end) with (arch))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:22
S30	157	(52/745.2.ccls. 52/745.08.ccls. 52/745.07.ccls. 52/86.ccls. 52/89.ccls.) and ((lift lifting hoist hoisting erect erecting) with (leg end))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:27
S31	81	(52/745.2.ccls. 52/745.08.ccls. 52/745.07.ccls. 52/86.ccls. 52/89.ccls.) and ((lift lifting) with (leg end))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/11/06 17:27
S32	1	("6794054").PN.	US-PGPUB; USPAT	OR	ON	2006/12/28 13:42
S33	2	("4039109" | "6419103").PN. OR ("6794054"):URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2006/12/28 13:43
S34	9	"2052598"	EPO; JPO; DERWENT	OR	ON	2006/12/28 13:48

EAST Search History

S35	16	"424478"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2006/12/28 13:51
S36	0	au424478	EPO; JPO; DERWENT	OR	ON	2006/12/28 13:51
S37	3	"1727667"	EPO; JPO; DERWENT	OR	ON	2006/12/28 13:51

Organization 3600 Bldg./Room KNOX(2)
U. S. DEPARTMENT OF COMMERCE
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450
IF UNDELIVERABLE RETURN IN TEN DAYS

OFFICIAL BUSINESS

U.S. OFFICIAL MAIL
PENALTY FOR
PRIVATE USE $300
UNITED STATES POSTAGE
PITNEY BOWES
02 1A
0004204479
$ 02.55⁰
FEB 12 2007
MAILED FROM ZIPCODE 22314

AN EQUAL OPPORTUNITY EMPLOYER

RECEIVED
FEB 13 2007
USPTO MAIL CENTER